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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/512,149 02/23/00 AGARWAL

V MI22-1322

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MMC2/1109

EXAMINER

PIZARRO-CRESPO, M

ART UNIT

PAPER NUMBER

2814

DATE MAILED:

11/09/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

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Office Action Summary

Application No.

09/512,149

Applicant(s)

AGARWAL, VISHNU K

Examiner

Art Unit

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

- 1) ☒ Responsive to communication(s) filed on 17 July 2000.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-55 is/are pending in the application.
- 4a) Of the above claim(s) 23-55 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claims 1-55 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some * c) ☐ None of the CERTIFIED copies of the priority documents have been:
1. ☐ received.
2. ☐ received in Application No. (Series Code / Serial Number) _____.
3. ☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2,3,5.
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other:

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Attorney's Docket Number: MI22-1322

Filing Date: 4/24/2000

Claimed Foreign Priority Date: none

Applicant(s): Agarwal

Examiner: Marcos D. Pizarro-Crespo

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1 to 22, drawn to a semiconductor device, classified in class 257, subclass 310.

II. Claims 23 to 55, drawn to a method of making a semiconductor device, classified in class 438, subclass 240.

2. Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case unpatentability of the group I invention would not necessarily imply unpatentability of the group II invention, since the device of the group I invention could be made by processes materially different than those of the group II invention. In this case the oxide-annealing step may be performed prior to the crystallization of the dielectric layer.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

5. During a telephone conversation with Mr. Mark S. Matkin on 10/10/2000 a provisional election was made without traverse to prosecute the invention of group I, claims 1 to 22, reading on a semiconductor device. Affirmation of this election must be made by applicant in replying to this Office action. Claims 23 to 55 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Specification

6. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The following title is suggested: Integrated circuit and a capacitor with an amorphous and a crystalline high-K dielectric layer.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1, 2, 4 to 9, 11 and 13 to 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Anderson.

9. Anderson show all aspects of the instant invention including an integrated circuitry comprising (Figure 2):

- A first capacitor electrode **20**
- A second capacitor electrode **24**
- A high dielectric constant layer between the capacitor electrodes comprising:
 - An amorphous material layer **23**
 - A crystalline material layer **22**

10. Regarding claim 2, Anderson teaches that a more efficient high capacitance performance is achieved in a capacitor comprising a dielectric region comprising an amorphous and a crystalline material constituting the same chemical composition (Col. 4, Lines 33-45).

11. Regarding claim 4, Anderson teaches that the upper and lower electrode generally comprises a suitably conductive metallic oxide or metal (Col. 3, Lines 14-18).

12. Regarding claims 5 to 9, 11 and 13, Figure 2 shows a capacitor over a semiconductor substrate, a dielectric layer received between two capacitor plates **20 24**, a crystalline dielectric material **22** contacting one capacitor plate **20**, an amorphous dielectric material **23** contacting a second capacitor plate **24**, wherein the dielectric region is the only capacitor dielectric region received between the capacitor electrodes **20 24**.

13. Regarding claim 15, Anderson discloses one embodiment of a capacitor being received over a semiconductor substrate with a high dielectric-constant amorphous layer between the substrate and a high dielectric-constant crystalline layer (Col. 2, Lines 49-57).

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson et al in view of Shimizu.

16. Anderson shows most aspects of the instant invention (see Paragraph 10). What Anderson does not show is a capacitor wherein the amorphous and the crystalline layer constitute different chemical compositions.

17. Shimizu discloses an invention relating to dielectric materials suitable to be used in capacitors (Col. 1, Lines 10-12). Furthermore, Shimizu et al. teach that by using at least two different dielectric materials in a condenser a sufficient high permittivity can be obtained, but also the dependence of permittivity upon temperature can be controlled (Col. 2, Lines 8-11, 13-24; Col. 4, Lines 60-68).

18. It would have been obvious at the time of the invention to one of ordinary skill in the art to have different chemical compositions between the amorphous and the crystalline dielectric layer in the capacitor disclosed by Anderson et al., because such a

modification will allow to control the dependence upon temperature for the dielectric region as taught by Shimizu.

19. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson in view of Ramakrishnan.

20. Anderson shows most aspects of the instant invention (see Paragraph 10). What Anderson does not show is a capacitor wherein the amorphous dielectric material is at least 98% amorphous, and the crystalline dielectric material is at least 98% crystalline.

21. Ramakrishnan teaches a method of forming capacitors on semiconducting substrates having insulating films with high-dielectric constants (Col. 1, Lines 6-9). Ramakrishnan also teaches that by controlling the thermal treatment process the degree of crystallinity of the dielectric layer can be controlled and by doing so one is able to create capacitors with a suitable value of dielectric constant on a single substrate (Col. 2, Line 65-Col. 3, Line 16). Ramakrishnan teaches that by controlling the dielectric constant one is able to control the capacitance of the condenser (Col. 4 Lines 24-40). Accordingly, it would have been an obvious matter of design choice to select the degree of crystallinity for the amorphous and the crystalline dielectric layer as taught by Ramakrishnan, since the degree of crystallinity of the dielectric layer is a variable of importance that allows to control the capacitance of the condenser.

22. Therefore, it would have been obvious at the time of the invention to one of ordinary skill in the art to select suitable degrees of crystallinity for the amorphous and crystalline dielectric layer, as taught by Ramakrishnan, according to the desired capacitance for the condenser.

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23. Claims 12 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson et al. in view of Graettinger.

24. Anderson shows most aspects of the instant invention (see Paragraph 9). What Anderson does not show is a capacitor wherein the semiconductor substrate comprises bulk monocrystalline silicon.

25. Graettinger teaches that in the processing of integrated circuits the wafer substrate typically comprises monocrystalline silicon (Col. 1, Lines 20-24).

26. It would have been obvious at the time of the invention to one of ordinary skill in the art to have monocrystalline silicon in the capacitor disclosed by Anderson et al., because in the processing of integrated circuits the wafer substrate is typically monocrystalline silicon as taught by Graettinger.

27. Claims 17 to 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson in view of Tsu.

28. Anderson shows most aspects of the instant invention (see Paragraph 10). What Anderson does not show is a capacitor dielectric region comprising Ta_2O_5 and received between two capacitor plates.

29. Tsu teaches that high dielectric Ta_2O_5 capacitors are easy to fabricate as compared to other high dielectric-constant materials (Col. 1, Lines 47-59).

30. It would have been obvious at the time of the invention to one of ordinary skill in the art to have a high-dielectric region comprising Ta_2O_5 between the two electrode plates of the capacitor disclosed by Anderson, because Ta_2O_5 capacitors are easy to fabricate as opposed to other high dielectric-constant materials.

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31. *Papers related to this application may be submitted directly to Art Unit 2814 by facsimile transmission. Papers should be faxed to Art Unit 2814 via the Art Unit 2814 Fax Center located in Crystal Plaza 4, room 4C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2814 Fax Center number is (703) 308-7722 or -7724. The Art Unit 2814 Fax Center is to be used only for papers related to Art Unit 2814 applications.*

32. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Marcos D. Pizarro-Crespo** at **(703) 308-6558** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via Marcos.Pizarro@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.


Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

33. The following list is the Examiner's field of search for the present Office Action:

Field of Search	Date
U.S. Class / Subclass(es): 257/310, 438/240, 361/313	10/16/2000
Other Documentation:	
Electronic Database(s): WEST (USPAT)	10/16/2000

MDP/mdp
10/16/2000

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